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(54) CONDITIONING OF FABRICS

(71) We, COLGATE-PALMOLIVE COMPANY, a Corporation organised under the Laws of the State of Delaware, United States of America, of 300 Park Avenue, New York, New York 10022, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the conditioning of fibrous materials, particularly fabrics.

As used herein the term "conditioning" means treating the fibrous materials to soften them and/or render them anti-static.

More particularly, the invention relates to articles for conditioning fabrics in laundry being dried in automatic laundry dryers.

For many years laundry and other fibrous materials have been softened by applying a substantive softening compound to them in the laundry wash water or rinse water. Such operations have certain disadvantages which have led to research to develop better softening techniques. One such method has been to apply a softening agent from a flexible resilient paper, cloth or sponge substrate. Disadvantages attend this procedure because the flexible substrate tends to become lodged in the laundry being treated, leading to excessive dispensing of the softening agent in a particular location, which often causes oily or greasy stains on the fabrics being treated. The flexible substrate, especially paper or cloth, may become wrinkled, twisted or knotted into smaller volumes and the release of the softening agent from them is inhibited. Also, a twisted substrate may become entrapped in the laundry and be difficult to find and remove after completion of drying. The present invention avoids the drawbacks of utilizing flexible substrates coated or impregnated with softening agents.

In accordance with one aspect of the present invention an article for conditioning fibrous materials, under such circumstances as obtain in an automatic laundry dryer, comprises a base having a volume of at least 5 cc which is inherently form-retaining and of such shape as to be readily tumbled with the laundry in such a dryer, such as rigid foamed plastic block, a hollow sphere or other geometric shape, and a conditioning agent on an external surface of the base or contained therein, which material is removable upon contact with tumbling laundry in a damp and/or heated state and transfers to the fibrous materials constituting the laundry so as to condition it. The conditioning agent may be in solid form on the surface of the form-retaining base or it may be in liquid form, preferably controllably dispensable from the interior of the base.

According to another aspect of the invention a method of treating fibrous materials with a conditioning agent comprises tumbling the fibrous materials in a damp and/or heated state with an article as aforesaid for long enough to apply to the fibrous materials sufficient of the conditioning agent to condition them.

Although a wide variety of embodiments of the invention will be described below, they all have in common the form-retaining nature of the conditioning article. In no case is the conditioning article surface free to flex, whereby conditioning agent might be caused to crack off and cause staining

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of fabrics, due to too high concentrations thereof being applied, and in no case is it possible for the conditioning article to be rolled or twisted in such a manner that the conditioning surfaces thereof are held away from contact with the laundry to be treated.

Various embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a central vertical cross-section of a rigid conditioning article, showing the conditioning coating thereon, minor penetration of the coating into the article and an internal weight to increase the density of the article;

Figure 2 is an elevation of the article shown in Figure 1 before use, showing the conditioning coating thereon;

Figure 3 is an elevation of the article shown in Figure 1 after use, showing the surface of the article after wearing away of the coating;

Figure 4 is a vertical cross-section of another form of rigid conditioning article;

Figure 5 is a perspective view of another rigid conditioning article, having some surfaces coated with conditioning agent and others uncoated; and

Figure 6 is a schematic illustration of apparatus employed to coat form-retaining base material with conditioning composition.

Another form of the invention in which liquid conditioning agent is dispensed through openings in a form-retaining container into contact with moving laundry in an automatic laundry dryer is shown in Figures 7—12.

Figure 7 is a perspective view of such an article having dispensing openings over substantially the entire surface of the article;

Figure 8 is a perspective view of a similar article, but with dispensing openings located on only an upper portion of the surface thereof;

Figure 9 is a central vertical cross-section of the article in Figure 7;

Figure 10 is a view of the interior of an automatic laundry dryer containing laundry to be conditioned and illustrating the conditioning article of Figure 7 in tumbling contact with such laundry;

Figure 11 is a central vertical section of an ellipsoidally shaped conditioning article having a spring-loaded dispensing opening; and

Figure 12 is a perspective view of another conditioning article, of different shape and with a different distribution of dispensing openings.

In Figure 1 is shown a conditioning article 10 having a rigid form-retaining base 11 with the surface 13 thereof coated with a softening agent 15 designed to be rubbed off onto tumbling articles of laundry coming into contact therewith. The base 11 illustrated is made of polystyrene foam, and as this has such a low density the density of the article as a whole is increased by emplacement of a weight 17 of heavier material. Such weight is indicated as centrally located but may be moulded in or otherwise located off-centre, so as to create an eccentrically weighted conditioning article. Numeral 19 indicates penetration of the conditioning agent below the outer surface of the polystyrene foam, such penetration assisting in maintaining the coating 15 intact on the form-retaining base 11.

In Figures 2 and 3 are shown views of the same conditioning article, before and after use. The message indicating that the coating of conditioning agent has been removed may be printed onto the polystyrene substrate before coating and is largely obscured by the conditioning agent until that agent is sufficiently removed to warrant replacement of the article.

In Figures 4 and 5 are shown views of other shapes of conditioning articles, both of which are only partially coated with conditioning agent. Thus, in Figure 4 is shown a slab of form-retaining base material 21 covered with fabric softening agent 23 on an upper surface thereof. In Figure 5 there is illustrated a paperboard cube or box 25, so constructed as to be form-retaining, which has anti-static agent on a face 27 and a different conditioning agent on another face 29. Thus both conditioning agents are applied simultaneously during treatment of the fabric being conditioned.

In Figure 6 there is shown a schematic representation of the coating of a continuous slab stock 31 of polystyrene foam or other suitable substrate with fabric conditioning agent to produce a coating 33 on the base 35. As illustrated, a solution or dispersion of fabric conditioning agent is fed from a trough 37 onto a roll 39 and thence onto the slab stock 31 to form a liquid cover 41 thereon, which cover will be of sufficient viscosity not to penetrate excessively into the surface of the slab stock but to penetrate into it sufficiently so that on solidification it will be firmly held thereto. The coated stock is then moved rapidly under drying apparatus 43 in which heat and air are directed onto the surface of the coating of conditioning agent, causing rapid evaporation of the solvent or dispersion medium and creation of a solid deposit of the conditioning agent on the slab stock. The arrow indicates the flow of air from a suction fan 45, which air removes solvent or dispersion medium with it. A knife 47 separates the continuous coated strip into individual articles for use in conditioning fabrics. These drop into a storage bin 49 and upon

completion of cooling and setting to their final state they are removed therefrom and are ready for use.

As shown in Figure 7, the base is in the form of a dispensing container 51 for a liquid fabric softener or other liquid conditioning agent. It comprises two hemispherical portions 53 and 55, each of which is perforated with many small dispensing openings 57 and 59, respectively. The upper hemisphere 53 has an internally threaded rim 61 and the lower hemisphere 55 has an externally threaded end 63, which enable them to be joined together to form a sphere. The material of the sphere is preferably a resilient plastic such as polyethylene or polypropylene, which is sufficiently heat-stable at the temperatures of operation to maintain the spherical form, while allowing some temporary distortions during tumbling, which facilitate dispensing of conditioning material through the perforations 57 and 59. Since the resilient nature of material of the base ensures that the article automatically resumes its original shape on removal of the force which causes the temporary distortion, such a base is deemed to be "form-retaining". Desirably, the perforations 59 in the lower portion of the sphere are of such size as to prevent the conditioning liquid from leaking out through them while the container is stationary and out of contact with other materials. To prevent such leakage under all conditions of viscosity and surface tension of the conditioning liquid, the lower portion 65 of another dispenser 67 is unperforated as is shown in Figure 8. Dispensing openings 69 in the upper portion of the sphere 67 are small and are circular in shape. The lower portion 65 of the sphere carries indicia 71 to aid in the measurement of the content of conditioning liquid 60. A threaded cap 73 having a notch 75 fits in the sphere and provides a filling opening when removed.

The internal construction of the container of Figure 7 is shown in Figure 9. However, instead of threaded joinder of the hemisphere, a frictional or snap joinder is indicated wherein a smaller rim portion 77 of the lower hemisphere 55 fits into a larger rim portion 79 of the upper hemisphere 53. A frictional fit may result, or, if desired, a bead may be provided on the rim portion 77 to snap into a groove in the rim portion 79. In the case of the container shown in Figures 7, 9 and 8, the thicknesses of the hemispheres are such that they are form-retaining enough to form tight closures and prevent leakage of conditioning fluid at the line of joinder.

In Figure 10 an automatic laundry dryer 81 has a horizontally rotating tumbling drum 83 which has internal projections or flights 85 therein to assist in raising the laundry articles 87 as the drum rotates in a clockwise direction. Inside the drum is shown the fabric conditioning dispensing article 51 of Figures 7 and 9 through the perforations 57 and 59 of which fabric conditioning liquid is discharged into contact with the fibrous materials to be treated. Such contact is effected either by inertial discharge of liquid as the movement of the sphere is halted when it contacts the laundry or by capillary action when the laundry contacts the liquid through an aperture in the dispenser. As the laundry containing the surface deposit of conditioning liquid continues to tumble into contact with other materials, some of the conditioning liquid is transferred to them, especially in those cases wherein the conditioner is not strongly substantive to fibres of the laundry. Means for rotating the tumbling drum, heating air, blowing the air through the drum and exhausting it with moisture removed from the laundry are conventional and are not illustrated.

In Figures 11 and 12 are shown other shapes of dispensing articles of the invention, that of Figure 11 being ellipsoidal and that of Figure 12 being cylindrical.

The ellipsoidal dispenser 89 shown in Figure 11 has perforations 91 over the surface thereof and includes a dispensing opening 93 closed by a spring-loaded valve 95. The spring of the valve is sufficiently strong to prevent leakage when the article is not subjected to shocks, but when dropped inside the dryer, as the drum rotates, the spring 97, which may have a weight attached to it to increase inertial forces, is moved away from the opening 93 and the closure member 99 moves downwardly, allowing passage of conditioning liquid 101 through the opening 93.

In Figure 12, a screw cap 103 closes an opening in an end 105 of cylindrical container 107. Perforations 109 allow dispensing of conditioning liquid in use, and the opening closed by the cap 103 allows easy filling with conditioning liquid.

A central concept of the form of the invention illustrated in Figures 1—6 is to have a conditioning agent for fabrics coated onto a form-retaining article which is employed as a means for effectively transmitting that coating to the fabrics to be treated. By using such an article in an automatic dryer or similar device, in which material to be conditioned is being tumbled, good, even distribution of conditioning agent over the fabric surfaces is obtained. Because of the form-retaining nature of the article, it does not become permanently distorted, rolled up, folded or readily buried or smothered in laundry or other fabrics being conditioned. The coating does not crack or flake off the base readily, because there is no excessive straining, caused by folding and bending of

the base. Because the conditioning agent is present substantially only at the surface of the base it is not wasted by being lodged in inaccessible portions thereof.

The bases may be of a wide variety of materials and constructions. Generally, it will be preferred that these be of light weight, the density being from 0.01 to 2 g/cc, preferably from 0.2 to 0.5 g/cc. The form-retaining base material may be either natural or synthetic. Various woods, such as balsa wood and other light weight woods, composition boards made from cellulosic material, e.g. pressed board, plywoods, resin treated woods and paperboards, light weight minerals, e.g. vermiculite or talc, preferably surface-treated to increase strength, and synthetic organic polymeric plastics, preferably foamed plastics, e.g. polyurethane, polyester, polystyrene, polyvinyl chloride or nylon foams, may be used. Perforated or expanded metals may also be used, providing that suitable means are present for assisting in holding the coating material to the metal and preventing it from cracking or flaking off. Hollow bases may be employed, with only the exterior surfaces coated with conditioning composition. Such bases may be formed by folding, moulding, cementing, fusing, stapling, interlocking or otherwise connecting the various parts thereof to make the final desired shape. Generally, to facilitate contact with tumbling fabrics and easiest application of conditioning agent to the surfaces of such fabrics in an even manner, it is preferred that the base should have a minimum of sharp corners, and curved surfaces will generally be convex. Although the base is form-retaining so as to avoid the various disadvantages of flexible substrates, it is not necessary that it be absolutely rigid. Thus, although rigid forms of plastics, for example, will generally be employed, a limited amount of surface flexibility can be tolerated, as in a natural or synthetic rubber ball, since under the circumstances of use such a structure will not undergo significantly great or objectionable distortion. Also, unlike sheets of paper or cloth or conventional thin sponge strips, even after a slight change of shape of the base, it will quickly return to its normal form. Such a form-retaining base may have its density modified by hollowing or adding weights, usually internally located, so as to provide a final product which will be of the right overall density to make best contact with tumbling fabrics to be treated.

In normal automatic laundry dryer operations, to promote best contact in the dryer with the articles being treated, the base has a volume of at least 5 cc and generally not more than 500 cc, preferably from 10 to 100 cc. Such sizes appear to tumble best with the laundry and make for most efficient coating of it. They also allow easy location and recovery of the exhausted conditioning article after use, compared to very small particles or beads of material. Nevertheless, different sizes may be employed.

The conditioning agents which may be used to coat the base may be any of the wide variety of materials or mixtures thereof. For example, there are those which act to soften fabrics and make them more pliable and less scratchy to the touch and the skin of the wearer. Various softening compounds, useful in the treatment of items made of synthetic fabrics, are also anti-static agents, acting to nullify the annoying electric shocks often experienced by the wearers of such clothing. The treatment of laundry also prevents it from adhering electrostatically to other such items, as it is removed from the dryer or as it is folded or otherwise treated afterwards. In addition to softening and anti-static agents, the conditioning agents may contain other compounds for imparting to the treated fabrics other desirable properties, such as antibacterial, anti-mildew, brightening and perfuming effects. In some applications, various conditioning agents may be combined in the same composition and in other applications different conditioning agents may be applied to the fabrics by differently coated portions of the article as it tumbles into contact with the fabrics.

Of the fabric softeners and anti-static agents, there may be employed a wide variety, including non-ionic, anionic and cationic substances. These are usually surface active materials and may be employed individually or in combination with other such materials.

Among the nonionic fabric softeners and anti-static agents that may be used are poly-lower alkoxy lower alkylene glycols, block copolymers of different lower alkylene glycols, higher fatty acid esters of poly-lower alkylene glycols, higher fatty alcohol ethers of poly-lower alkylene glycols, similar compounds wherein triols such as glycerol and higher polyols such as pentaerythritol are substituted for the glycol moiety, and other nonionic conditioning agents containing balanced hydrophilic and lipophilic groups which contribute to their surface activity and conditioning properties. The lower alkylene and lower alkoxy groups are of 2 to 5 carbon atoms and the higher fatty groups are of 10 to 20, preferably from 12 to 18, carbon atoms. The molecular weights of the various polymeric portions of molecules are usually at least 150 and preferably are from 300 to 25,000, although in suitable circumstances higher and lower weight polymeric portions are also applicable. Also of use are amides, including alkanolamides, e.g. higher fatty amides and higher fatty acid mono- and di-

lower alkanolamides, wherein the carbon atom contents are as previously indicated.

The anionic conditioning agents may be any of the various surface active anionic softeners and anti-static agents, including water-soluble sodium, potassium, ammonium or magnesium synthetic anionic organic detergent salts, such as higher fatty alcohol sulphates, higher fatty alcohol sulphonates, linear higher alkyl benzene sulphonates, higher fatty acyl taurides and isethionates, higher fatty acid monoglyceride sulphates and higher fatty acid sarcosides and glycines. Generally, the cation of such compounds will be an alkali metal or other water-solubilizing radical or element and in the lipophilic portion of the molecule, the anionic portion, the higher fatty or higher acyl groups will be of 10 to 20 carbon atoms, preferably of 12 to 18 carbon atoms. In addition to the synthetic organic detergents, primarily of the sulphated and sulphonated types, other materials such as the phosphates and borates, may be used. Also of utility is the softening activity of the soaps which are ordinarily referred to as water-soluble, being the alkali metal, ammonium or substituted ammonium soaps of higher fatty acids, e.g. sodium stearate and triethanolamine laurate.

Of the cationic softening agents the most preferred are the water-soluble quaternary ammonium salts but corresponding quaternary phosphonium salts can also be useful. Quaternary ammonium compounds constitute a known class of fabric softeners. They usually contain a plurality of lower alkyl groups on the quaternary nitrogen atom and one or two higher alkyl groups thereon. The salt-forming ion is preferably a halide, such as chloride, iodide or bromide, but may also be any other such useful solubilizing group, including acetate, benzoate, saccharinate, methosulphate, ethosulphate and bisulphate. Among preferred examples of such cationic compounds of the quaternary type are cetyl trimethyl ammonium bromide, dimethyl dilauryl ammonium chloride, diethyl distearyl ammonium chloride, dimethyl di- (hydrogenated tallow alkyl) ammonium chloride, stearyl dimethyl benzyl ammonium chloride and lauryl methyl dibenzyl ammonium bromide. Also useful are various other cationics, such as alkyl pyridine salts, alkyl imidazolines, higher alkyl amines of the primary, secondary or tertiary types, and higher alkyl guanidine salts, e.g. 1-methyl-1-stearyl aminoethyl-2-stearyl imidazolinium methosulphate, stearyl pyridinium halides, cetyl isoquinolinium bromide and alkyl morpholinium chlorides. In the aforementioned cases, lower alkyl is of 1 to 5 carbon atoms and higher alkyl is of 10 to 20 carbon atoms. Mixtures of the nonionic conditioning agents may be employed in conjunction with either the anionic or cationic softeners or anti-static agents and with a wide variety of materials for imparting other properties to the fabrics. Generally however, mixtures of anionics and cationics should be avoided, because of objectionable interaction. However, amphoteric conditioners may also be used.

To improve the properties of the conditioning agents, either physically or chemically, various other substances may be incorporated with them to improve their softening properties, softening points, water-solubility, resistance to cracking and flaking, and hardness, and to make them non-staining and readily removable from treated fabrics. It is most desirable that the final softening composition be easily applied to the base, of desired viscosity to promote partial entrance into the base but to maintain most of the softening material exterior to the surface thereof, and of excellent softening properties, yet readily and completely removable from the treated fabric upon washing. Spotting or staining of the treated laundry is to be avoided.

Generally, the conditioning agent is chosen, and modifiers, if desired, are employed with it, to obtain the most desirable physical characteristics that will allow a coated article to be prepared easily, shipped and stored at ordinary temperatures and used effectively after storage, with good dissolving and/or softening action under dryer conditions to obtain best transfer of the conditioning agent. It has been found that waxy appearing compositions are best and preferably, the conditioning agents chosen are those of this nature and are sufficiently hard themselves to be employed without modifiers. When other materials are used in the coating compositions, they will preferably comprise a minor proportion thereof, so that ordinarily from 50 to 100%, preferably from 80 to 100%, of the composition will be active conditioning agent.

The thickness of the coating applied to the base will generally be in the range of from 0.0005 to 0.5 cm but the extremes of this range are only rarely useful. Normally the thickness will be from 0.002 to 0.3 cm and preferably from 0.01 to 0.1 cm. Such thickness is that external to the outer surface of the base. A porous or rough surfaced base or one having indentations therein may have some of the applied conditioning agent penetrate below the surface to a sufficient depth to hold the external coating firmly to the surface and prevent its cracking or flaking off from the surface during use. Thus, a minor proportion of the external thickness of conditioning composition may be present below the surface. Usually it will be desired to keep this proportion as small as feasible because the conditioning composi-

tion below the surface of the base will often be unavailable for application to laundry and will be wasted. Usually the subsurface proportion of coating composition will be from 10 to 30% of that exterior to the base. In terms of weights applied, the conditioning composition will usually be employed in the range of 0.0005 to 0.5 g/cm² of base surface, preferably from 0.002 to 0.3 g/cm² and most preferably from 0.01 to 0.1 g/cm².

So that the conditioning composition may have best utility under the circumstances of operation of a normal home automatic laundry dryer it should be at least partially water-soluble or dispersible at a temperature within the normal operating range of a dryer. Also, it should be form-retaining at temperatures below 30°C, so that it does not run off the base in storage where temperatures may be above that point. In the dryer, initially the hot air blown through the damp or wet clothing will be much reduced in temperature, due to the evaporation of moisture from the clothing and the dropping of the surface temperature of the clothing to the wet bulb temperature. Under such conditions, when the temperature may drop as low as 10°C, the initial removal of conditioning agent from the base may be partly due to softening of the article by the presence of the moisture in the clothing. Subsequently, as the temperature in the dryer increases, the coated article becomes warmed and the conditioning agent further softened to make rubbing off of the conditioning agent onto the laundry easier. With the types of bases described and of the sizes mentioned the small quantities of conditioning agent softened by a combination of moisture and heat effects are abraded onto the clothing and then spread over the clothing by the rubbing effects of other fabrics touching the points at which the conditioning agent has been applied. Such action is so fast that there is little opportunity for the deposit of too much conditioning agent, providing that it does not flake off from the base.

The manufacture of the article is relatively simple when the considerations for making a successful product, previously mentioned, are kept in mind. The appropriate conditioning agent is prepared as a solution, emulsion, dispersion or sprayable composition or, as is often preferred, as a melt. When melts are employed, soon after application the surface is cooled and the melt is solidified. When solutions are employed, the solvent contents thereof will normaly be from 20 to 80%, preferably 20 to 40%, it being kept in mind that it is not necessary to dissolve the conditioning agent completely. If considered desirable, the viscosity of the coating composition may be adjusted by temperature regulation, or thickeners may be added to it, providing that they have no adverse effects on the laundry being conditioned. The application of the coating composition is made to the desired depth on the base either in a single step or in a plurality of repeated steps wherein, following each application, the melt is cooled or the solvent is evaporated to form a dry and form-retaining coating on the base. Penetration of the rough surface of the base may be regulated by adjusting the composition viscosity or by modifying the base surface to include depressions or other structure in which the coating composition may find gripping contact. In some cases, as when polymeric plastic foams are being used, any very rough edges thereof which might tend to catch on tumbling laundry may be removed before application of the coating composition.

A method of applying a coating to a single surface of an object which is to serve as a conditioning article is illustrated in Figure 6. Modifications of this method may be employed wherein a coating is applied to the bottom of the strip of plastic, so as to limit penetration. Also, combinations of roll coating, dip coating and spray coating may be used. The main consideration will be to make sure that the coating conditions, drying and/or cooling, composition viscosity and base characteristics will be such as to result in the desired thickness and penetration by the coating composition. Generally, the temperature of cooling gas will be ambient, preferably from 10 to 30°C, and the cooling or solvent-removing air flow will be high, usually at a velocity of from 0.3 to 3 metres per second past the surface of the coated base. Care should be exercised to prevent substantial impregnation of the article, or penetration into a hollow interior portion thereof, by the coating composition, since such composition will usually be unavailable for conditioning action, due to its inaccessibility. Although for simplicity of illustration, the coating method illustrated is an automatic one involving the coating of continuous strips of base material and subsequent dividing of this into suitable lengths, modifications of the method, as mentioned above, may be employed for coating articles of various shapes. Thus, spheres may be rolled or tumbled in a shallow melt or solution of conditioning composition, repeatedly dried or cooled and re-treated. In some cases they may be attached to a wire and led through a melt or solution of conditioning composition, providing that conditions are so regulated as to prevent impregnation.

The use of the articles is simple and trouble free. In fact, one of the main advantages of the articles is that they may be employed by untrained housewives to con-

dition laundry conveniently and accurately. Thus, it is only necessary that the housewife remove one or more of the articles from a package and add it to the dryer with the laundry to be dried. To obtain combination conditioning effects one may use a mixture of different conditioning articles, a hybrid composition on a single article, or articles having different conditioners on different parts thereof. Preferably, the addition of the articles will be after the laundry has been placed in the dryer and immediately before dryer operation begins. The articles are particularly suitable for use in home automatic laundry dryers of the types wherein a heated forced air blast is directed into a revolving drum containing tumbling laundry. However, they are also useful in commercial and industrial dryers and tumbling equipment operating under similar conditions. While it is normally intended that both heat and circulating air should be used, in some circumstances it may be unnecessary to employ either of these. Sometimes, it may be sufficient to tumble the damp laundry into contact with the article, even without drying air or heat. In such cases, drying may be conducted subsequently. A tumbling motion of the laundry in the revolving drum is important, however. If the drum is too full, so that the laundry merely spins around with the drum, it might be that contact of the conditioning compositions with the fabric would be maintained too long in one place, which could lead to straining or spotting with certain compositions. To prevent this, and to be sure of maintaining a relative tumbling action between the laundry and the conditioning article, wherein the moving laundry rubs against the conditioning article, the load of wash in a home dryer will normally be from 2 to 5 kilograms, dry weight, so that it does not fill the entire dryer and prevent tumbling. Such weights of laundry will generally occupy from 10 to 70% of the volume of the dryer and preferably will occupy from 30 to 60% thereof. In addition to the free volume in the dryer, the speed of rotation of the drum is of importance. To get good relative tumbling effects between the article and the laundry, the speed generally should be 20 to 100 revolutions per minute, preferably 40 to 80 r.p.m. In such circumstances the laundry is moved quickly past the conditioning article and excellent transfer of conditioning agent is obtained. Drying will usually take from 3 minutes to 2 hours, generally between 20 minutes and 1 hour when the drying gas employed is circulated frequently, changes of the volume of gas in the dryer drum being at the rate of about 5 to 50 per minute and the gas temperature being 10°C to 90°C, preferably from 50 to 90°C.

The presence of flights or other interruptions on the smooth internal wall of the revolving drum assists in creating a good tumbling effect. This is of importance because the height from which laundry or conditioning article is dropped, and its weight, affect the force with which contact is made between article and the laundry and affect the amount of conditioning agent rubbed off onto the laundry. As would be expected, the longer the tumbling continues, the more evenly distributed will be the conditioning agent and the more will have been applied. Yet even if distribution is not perfectly even, good conditioning effects are obtained due to the softening of the fibres at a sufficient number of points so that the overall effect is a softness from the interposition of softening points at which the fabric is pliable.

After completion of the softening operation, the conditioning article is removed and examined. If sufficient softener remains, the article may be employed again, until complete removal of the coating. To obtain different levels of conditioning activity or different conditioning effects, a plurality of conditioning articles may be used at one time or sequentially. After consumption of the coating, the bases may be disposed of or if desired, may be re-coated. Coating compositions of the types described herein may be marketed in appropriate solvents or in other systems to allow the user to recoat the bases, if desired.

The dispensing containers illustrated in Figures 7 to 12 may be made of any suitable material for holding the conditioning composition. Thus, metal, mineral, rubber, synthetic organic polymeric plastics and suitable material of animal and vegetable derivation, such as modified or treated cellulose or proteinaceous material, can be employed. Of these, it is preferred to utilize synthetic organic plastics materials or rubber, since they can be made with desired wall thicknesses, can have dispensing openings moulded or readily formed in them, are economical to manufacture, may be produced in a wide variety of shapes and forms, are aesthetically pleasing to the consumer and can be made to possess a desired degree of resilience, although they are essentially form-retaining, even after temporary distortions.

Of the polymeric materials that may be employed those most preferred are the poly-lower alkylenes, such as polyethylene, either of high or low density, as the situation indicates, and polypropylene. In addition to these poly-lower alkylene materials, one may also use other suitable synthetics such as polyesters, especially glass fibre reinforced polyesters, polyvinyl chloride, nylons, polyurethanes, either flexible or rigid, and polystyrene. The polyurethanes and polystyr-

enes may sometimes be employed as foams, either rigid or somewhat resilient. Rubbers, such as natural rubber, neoprene, buna-S and other rubbers or rubber-like materials are also useful. Such materials may be pure or may contain suitable additives such as plasticisers and colouring agents. They may be printed with designs, indicia or instructions. Often it will be preferred to use those which are transparent, or at least translucent, so as to reveal the amount of material still in the container during or at the cessation of a conditioning operation.

As is illustrated in the drawings, the container may be of any suitable shape, although for purpose of best transfer of conditioning agent to fabrics or laundry it has been found that curved shapes are preferable. These seem to make a better rolling contact with the articles being treated and thus allow better distribution of the dispensed conditioning agent at the time at which it first contacts the articles being treated. Of the various shapes which are usable, the spherical is preferred, although other completely convexly curved articles are also useful. Sharp edged or concave structures are usually to be avoided but may be acceptable in some cases. Thus, preferred shapes include spheres, ellipsoids, cylinders, especially those having rounded ends, twin paraboloids or hyperboloids joined at their larger ends, and similar forms. Exterior surfaces will usually be smooth but may be rough, spongy or irregular, if desired.

The containers are usually hollow and have wall thicknesses sufficient to prevent them from collapsing and to make them form-retaining, i.e. they are rigid or, if not rigid, resilient enough to return to their initial shapes after being distorted in use. They may contain materials such as sponge, paper, cloth or other suitable absorbents, which may act to regulate the rate of release of conditioning liquid from the container. Also, they may contain weights to impart to them particular motions during tumbling, attributable to a shift in weight position, or such weights may be used to cause the tumbling container to contact with greater force the materials to be treated. Normally, however, the containers will be hollow and of substantially regular wall thickness, generally from 0.1 cm to 0.5 cm.

The dispensing container will have at least one dispensing opening and generally a plurality of these will be present. They may be regularly distributed in the container walls or in selected locations thereon, generally near the "top" thereof to prevent undesired leakage of conditioning liquid before intended use. When a plurality of multiplicity of openings is employed the number will usually be from 4 to 100, preferably 10 to 50, and the sizes of the openings, which may be same or different, will generally be from 0.0001 to 0.1 cm^2, most often from 0.0005 to 0.01 cm^2 and preferably from 0.005 to 0.05 cm^2, in area. Although various shapes of openings may be used, circular is preferred, and the diameters of such circles will preferably be from 0.1 cm to 0.2 cm. Instead of a plurality of openings, through which conditioning liquid is dispensed by capillary action upon contact of the liquid at the surface of the opening with the fabrics to be conditioned, or by the shock of contact with the fabrics when being tumbled in a treating machine, such as an automatic laundry dryer, a spring controlled valve or other normally closed dispensing closure may be used which is opened in response to such shocks.

The volume of the dispensing container will be chosen to be sufficient to hold the amount of liquid conditioning agent to be applied. When high dilutions of conditioning agents are desirably applied, to promote even application to the materials to be treated, larger volume containers will be employed. Correspondingly, when a plularity of dispensing containers is being used, when the load of materials to be treated is small, and when the treating liquid is readily distributed over the surface of the materials to be treated, smaller containers may be utilized. The range of container sizes is wide and containers as large as 2.5 litres can be used. Generally, it will be desirable to employ containers having a volume of from 50 cc to 2 litres, preferably of 100 cc to 1 litre.

Compounds useful as softeners have been described previously. They may be in the liquid state under the conditions of application or may be dissolved in suitable solvents. They may contain additional compounds, such as solubilizing agents or release agents, or they may be used alone. The solvents employed may be any suitable solvents, such as lower alcohols, esters, aldehydes, ketones or polyols, either alone or mixed with other solvents, such as water. However water is the preferred solvent because of its good solubilizing effect, low cost, non-flammability and compatibility with conditioning agents. Of course, the solvents are not considered to be conditioning agents because they are readily removed from the "treated" fabrics by evaporation and have no lasting effects.

The concentration of conditioning agent, if a solution is employed, and the other properties of the conditioning agent used, will be such as to result in a product of viscosity and surface characteristics which cause it to be dispensed at a desired rate from the container during the conditioning operation. Because they spread more readily over laundry being conditioned, the anionic and nonionic

conditioning agents may generally be employed at higher concentrations than the highly substantive cationic softeners. Usually, in aqueous solutions the concentration of fabric softener will be from 0.05 to 20%, preferably from 0.1 to 10% and most preferably from 0.3 to 5%. The viscosity of such a solution at the temperature of use will generally be from 0.2 to 10 centipoises, usually from 0.3 to 5 cps. and is preferably from 0.5 to 3 cps. Viscosities in these ranges allow good dispensing through a plurality of openings of the sizes indicated previously. Rates of dispensing should be such that the liquid charge is delivered within about 2 to about 50 minutes under use conditions. Usually, dispensing will be effected within 5 to 20 minutes. Dispensing will be gradual and at a substantially constant rate.

To prepare the conditioning articles of Figures 7—12 is a simple matter. It is only necessary to add the conditioning liquid to the article by any suitable method, preferably through a filling opening, after which the opening is sealed and the product is ready for use. If it is desired to prepare several conditioning articles from a solution of conditioning agent, they may all be filled and then kept cooled or frozen before use to prevent loss of dispensing liquid through the dispensing openings. Alternatively, they may be stored in plastic containers or have plastic skins formed about them to prevent leakage.

The automatic laundry dryer or equivalent machine which may be employed in performing the invention may be any of the well known commercial or industrial types of such machines. Generally, these are gas or electric dryers which contain a drum which rotates about a substantially horizontal axis and which has openings therein for the passage of drying air through the drum and through the contained laundry which is being dried. The fronts of such machines will usually include an outwardly swinging door which is substantially vertical and closes the substantially cylindrical dryer drum to prevent laundry from being discharged from it unless the door is opened. Dryers of this type usually have drums of a diameter between 0.5 to 1.5 metres; home laundry dryers usually having a diameter from 0.7 to 1 metre. The generally cylindrical form of the dryer drum may be modified by being rounded or tapered at various portions thereof and it will usually contain internal baffles, flights or other projections to aid in satisfactory tumbling the laundry being treated. The material of construction of the dryer drum and door will normally be porcelainized or enamelled metal, but plastics, reinforced plastics, special glasses or ceramics or other suitable materials of construction may also be used. It will often be preferred to have a dryer door which has a transparent portion of synthetic organic polymeric plastic material or glass so as to allow the user to view the laundry and the conditioning article employed in the dryer.

EXAMPLE 1

Foamed polystyrene spheres having a diameter of 4 cm, cut from a slab of styrofoam board, are dip coated, by repeated rapid immersions and evaporations of solvent, using an aqueous alcoholic suspension of a block copolymer of ethylene oxide and propylene oxide sold as "Pluronic F-127" by Wyandotte Chemical Company, U.S.A. in ethanol (SD40 alcohol). The proportions of ingredients employed are 2:1. The evaporation of solvent is by heating and blowing with air at room temperature. The coated spheres made are of a density of about 0.2 g/cc, due to containing an internal weight to increase the density. Before coating, the polystyrene balls are smoothed down, using a fine sandpaper or buffing brush so as to remove any rough edges thereon which might become entangled in laundry to be conditioned. The total thickness of the coating deposited is about 0.2 cm and it is applied over the entire surfaces of the polystyrene spheres. The weights of the conditioning compositions applied per sphere range from 2 to 13 grams.

In use, one such conditioning article is added to a home automatic laundry dryer of the horizontal axis flighted tumbling drum type after addition of a 4 kg wash load of mixed laundry, which is approximately 50% synthetic and 50% cotton or rayon in content. The synthetics employed include nylon, polyester-cotton blends and other synthetics, of which the nylons are most prone to electrostatic effects. Some of the materials are resin coated, permanently pressed items. Immediately after addition of the conditioning sphere, the operation of the dryer commences and drying air at a temperature of 70°C is forced through the dryer at the rate of 5,000 litres per minute, with the drum rotating at a speed of about 60 r.p.m. Initially the temperature of the damp laundry is low, approximately 20°C, but after most of the drying has been completed, it increases to almost 70°C. The conditioning coating on the surface thereof softens a little initially, due to the action of water and some heat in contact with it and when the temperature of the spheres becomes appreciably warmer, about 60°C, the coating becomes plastic.

After 50 minutes of drying, the machine is turned off and the laundry is removed. It is satisfactorily dry, possesses no electrostatic activity and feels soft to the touch, compared to a similar load not treated by the method of this invention. The clothing

treated in the dryer exhibits no spots or stains from excessive contact with conditioning agent. The styrene ball is readily located among the laundry and is removed.

When, instead of the non-ionic softening agent being employed, an equivalent proportion of an aqueous alcoholic solution of a sodium tallow alcohol sulphate slurry which comprises 28% of active ingredient, 6% of sodium sulphate and 66% of water, and ethanol in equal proportion is used, good softening effects and no spotting or staining are noted. In this case, the addition of approximately 10% of paraffin wax or higher fatty monoglyceride aids in preventing flaking off of softening agent during tumbling in the dryer. Also aiding in such effect is the sub-surface conditioning agent in the closed cell polystyrene sphere, which coheres with the external material.

Similar effects are obtained by employing other shapes of form-retaining bases made from other light weight materials, e.g. paperboard, wood, minerals and other synthetic organic plastics. Also, when other anionic or nonionic softeners and antistatic agents are used, such as higher fatty acid soaps, monoglyceride sulphates, linear alkyl benzene sulphonates or higher ethers and esters of polyoxyethylene glycol, good conditioning effects are also obtained.

EXAMPLE 2

3 grams of a quaternary ammonium chloride softening and antistatic agent of the type known as "Arquad", a product of Armour Chemical Company, U.S.A., are applied to both major surfaces of a slab of foamed rigid polyurethane of approximately twice the surface area of the spheres described in Example 1 and to other bases of similar surface areas, including paperboard cubes, polystyrene foam spheres and balsa wood discs. Applications to the latter three types of structures are by repeated sprayings. The particular quaternary compound employed is dimethyl, di(hydrogenated tallow alkyl) ammonium chloride and it is present in a solution-suspension, approximately 40% of the total weight being aqueous alcoholic solvent, of which 80% is water and 20% is isopropanol. The major surfaces of the various bases are coated with the conditioning composition and the solvent is quickly evaporated off. In a similar manner, for comparative purposes, a similar weight of conditioning composition is applied to a paper towel of corresponding area, using both sides of the towel. In the various cases, except where the paper towel has been impregnated with softening agent, the penetration of such agent below the external surface of the base is held to about 20% of that outside the base surface. In the paper towel, the coating composition completely impregnates it and the internal conditioning agent is more than half the thickness of the external deposit on the base.

The various conditioning articles are tested by being added to loads of laundry processed in the same washing machine and dryer, in a manner described in Example 1. After completion of treatment, the paper towel impregnated with softening composition is difficult to locate and is sometimes finally found in creased and folded condition buried inside an item of laundry. On the other hand the form-retaining articles made according to the present invention are readily located and are not entrapped within particular pieces of laundry. Conditioning effects obtained are about the same despite the entrapment of the paper article, if that entrapment occurs in the latter part of the conditioning process, but a significant difference is noted between the "control" and "experimental" methods, in that the laundry treated with the paper towel item sometimes exhibits greasy or waxy spotting and discoloration, due to deposits of large quantities of conditioning agent on the laundry during the period when trapped and in some cases due to reaction with metal in the laundry. The severe staining obtained from the treated paper towel, even if occurring only occasionally, is bad enough to make such a product unacceptable to the housewife, inasmuch as the stain is very difficult to remove and often requires dry cleaning, which is sometimes unsuccessful.

EXAMPLE 3

Aqueous solutions of various fabric softeners, most of which also possess antistatic and anti-wrinkling properties, are prepared at a variety of concentrations and are tested for softening utilities in dispensing containers of the present invention. One litre of each of the solution made is filled into a hollow polyethylene sphere of the type illustrated in Figure 8, containing 24 circular holes of an average diameter of about 0.13 cm. The holes are located in the upper portion of the ball, as is a filling opening. The ball is approximately 22 cm in diameter and the opening is about 2 cm in diameter.

After filling one litre portions of conditioning solution into the ball, the operation of the dispenser is tested in a practical conditioning test conducted in a commercial electric automatic laundry dryer of the horizontal axis tumbling drum type. In some tests gas dryers are also used. In such a test, a front loading clothes dryer is partially filled with damp laundry to be dried, the dispensing container of conditioning agent solution is placed in the dryer and drying is commenced.

The laundry treated is the usual mixture

of wearing apparel and household articles of Example 1, totalling 4 kilograms, dry weight, and the circumstances of dryer operation are the same.

The conditioning agent solution is dispensed from the container onto the surfaces of the fabrics being treated, as the container is brought into contact with the fabrics and is subjected to the shocks of movement in the dryer. The dispensing is complete within about 2 to 40 minutes and generally within from 5 to 20 minutes. After 50 minutes of drying the machine is turned off and the laundry is removed. It is found to be soft to the touch, static-free and substantially unwrinkled, compared to a similar load in which the conditioning article is not employed. The clothing treated has no oily or greasy spots or stains on it. After consumption of the conditioning solution, the dispenser is re-filled and used again for another load of laundry. In some cases, where less conditioning is required, the automatic laundry dryer operation is halted temporarily before complete dispensing of the contents of the conditioning and the article is removed. To condition the 4 kg of mixed laundry charged, from 0.5 to 100 grams of conditioning agent is used, generally from 1 to 10 grams and preferably from 1 to 5 grams.

The following table describes the softening effects obtained.

TABLE 1

Conditioning agent	*Conditioning (% Active Basis)*	*pH*	*Softening Effect*
Tallow alcohol sulphate	1.0	—	good
Coconut oil diethanolamide, modified (Varamide A10)	5.0	9.1	fair
Nonionic softener (Emersoft 7777)	5.0	4.6	good
Nonionic softener (Emersoft 7780)	5.0	4.2	good
Dimethyl stearylamine oxide (Aromox DM18W)	1.0	6.3	good
1-methyl-1-stearyl aminoethyl-2-stearyl imidazolinium methosulphate (Culversoft S-75)	0.3	4.7	good
Same	0.5	4.6	excellent
Same	1.0	3.9	good
Same	2.0	3.8	excellent
Same	3.0	3.7	excellent
Same	4.0	3.9	excellent
Dimethyl di-hydrogenated tallow alkyl ammonium chloride (Arquad 2HT ...	0.3	5.4	good
Same	2.0	5.3	excellent
Same	5.0	5.3	excellent
Amphoteric softener (Miranol SHD Conc.)	0.3	11.3	fair

In our British Patent Application No. 48099/71 (Serial No. 1,382,431) there is claimed an article for conditioning fabrics (i.e. softening and/or imparting anti-static properties to the fabrics), suitable for addition to laundry for treating laundry in an automatic laundry dryer, which comprises a rigid base carrying a solid fabric conditioning compositioning comprising a C_8—C_{22} fatty acid C_1—C_5 alkanolamide or a mixture

of such alkanolamides; or a mixture of a poly(ethylene oxy or propylene oxy)-containing surface active nonionic compound of a molecular weight in the range of 300 to 25,000, and a water-soluble surface active sulphate or sulphonate salt, in a weight ratio in the range from 1:10 to 10:1; or a mixture of a fabric-substantive cationic conditioning compound and a poly(ethylene oxy or propylene oxy) C_3—C_{22} alkyl amine or poly(ethylene oxy or propylene oxy)nonionic surface active agent as a release agent to promote the release of the cationic conditioning compound from conditioned laundry upon subsequent laundering. No claim is made herein to an article as claimed in our aforesaid British Patent Application No. 48099/71 (Serial No. 1,382,431).

Subject to the foregoing disclaimer,

WHAT WE CLAIM IS:—

1. An article for conditioning (as hereinbefore defined) fibrous materials, under such circumstances as obtain in an automatic laundry dryer, comprising a base having a volume of at least 5 cc which is inherently form-retaining and of such shape as to be readily tumbled with the laundry in such a dryer, and a conditioning agent on an external surface of the base or contained therein, which conditioning agent is removable upon contact with tumbling laundry in a damp and/or heated state and transfers to the fibrous materials constituting the laundry so as to condition them.

2. An article according to Claim 1 wherein the conditioning agent comprises a fabric softening agent and/or an anti-static agent.

3. An article according to Claim 2 wherein the conditioning agent comprises a synthetic organic anionic, nonionic or cationic surface active agent or mixture of such agents.

4. An article according to Claim 3 wherein the conditioning agent comprises a cationic quaternary ammonium salt fabric softening agent.

5. An article according to any of the preceding Claims wherein the base has a surface which is sufficiently rough to allow limited penetration of the conditioning agent sufficient to bind an external coating of the conditioning agent thereto and prevent flaking off thereof during drying operation, and is sufficiently rigid to prevent distortions thereof upon contact with tumbling laundry.

6. An article according to Claim 5 wherein the base comprises a synthetic polymeric foam, the thickness of the coating is from 0.002 to 0.3 centimetre and a minor proportion of such thickness is internal to the surface of the base.

7. An article according to Claim 6 wherein the foam is of polystyrene, the surface of the foam before coating is sufficiently devoid of jagged edges to prevent adherence to tumbling laundry after removal of the coating of conditioning agent, the foam base is in the shape of a sphere and the volume thereof is from 10 to 100 cubic centimetres.

8. An article according to any of Claims 1 to 4 in which the base is a dispensing container of liquid conditioning agent with an opening through which the conditioning agent is gradually dispensed into contact with fibrous materials to be conditioned, upon contact of the container therewith.

9. An article according to Claim 8 wherein the liquid conditioning agent is of a viscosity from 0.3 to 5 centipoises and a plurality of dispensing openings is provided in the container, each of which is of a cross-sectional area of 0.0001 to 0.1 cm^2.

10. An article according to Claim 9 wherein the liquid conditioning agent is an aqueous solution which comprises from 0.1 to 10% of fabric softener, the container is of a volume from 50 cc to 2 litres, and the dispensing openings are of such size that unless the container is contacted with fibrous material to be treated or subjected to shocks, the surface tension of the solution will prevent dispensing of the solution through the dispensing openings.

11. An article for treating fibrous materials to condition them substantially as described with reference to Figures 1 to 3, or any of Figures 4, 5, 7, 8, 9 and 11, of the accompanying drawings.

12. A method of treating fibrous materials with a conditioning agent which comprises tumbling the fibrous materials in a damp and/or heated state with an article as claimed in any of the preceding Claims for long enough to apply to the fibrous materials sufficient of the conditioning agent to condition the laundry.

13. A method according to Claim 12 wherein the drying takes place in a tumbling drum, filled in tumbling state with from 10 to 70% of its volume of laundry, the drum is rotating at a speed of from 20 to 100 revolutions per minute, the temperature of the drying gas employed is from 50 to 90°C, the time of drying is from 3 minutes to 2 hours, and the conditioning agent is removed from the base of the article during the operation of the dryer by contact of the conditioning agent on the base surface with laundry when this conditioning agent is softened by a combination of moisture and heat.

14. A method according to Claim 12, substantially as described in any of the Examples.

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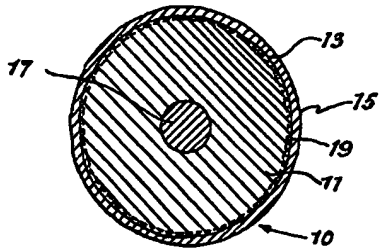

Fig.1.

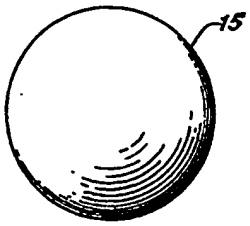

Fig.2.

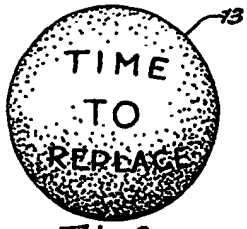

Fig.3.

Fig.4.

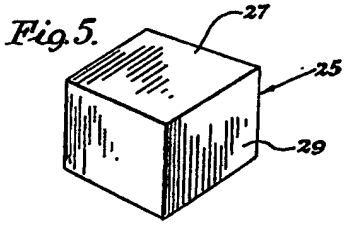

Fig.5.

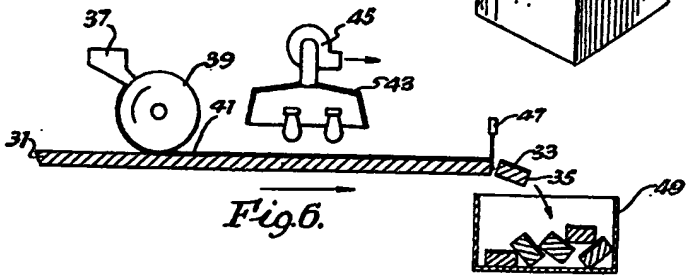

Fig.6.

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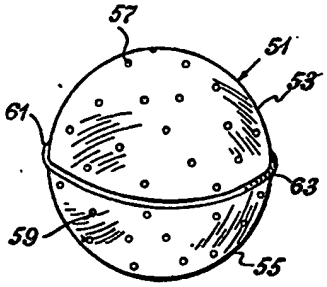

Fig. 7

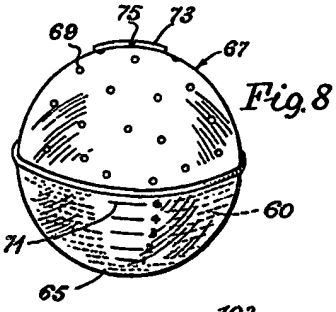

Fig. 8

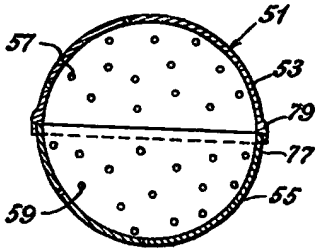

Fig. 9

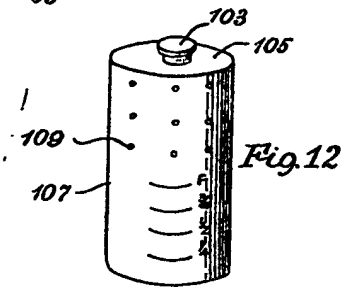

Fig. 12

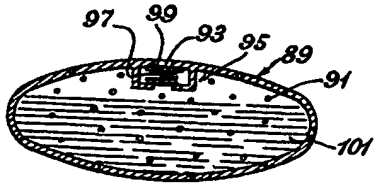

Fig. 11

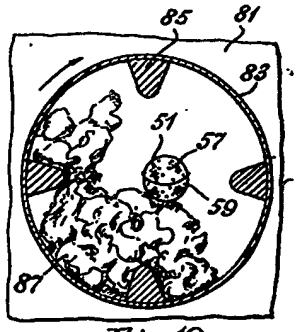

Fig. 10